Nitrogen Rejection Unit Optimization

NaturalGas EPA POLLUTION PREVENTER

Partner Reported Opportunities (PROs) for Reducing Methane Emissions

PRO Fact Sheet No. 907

Applicable sector(s):

☐ Production ■ Processing ☐ Transmission and Distribution

Partners reporting this PRO: BP

Other related PROs: Require Improvements in the Quality of Gas Received from Producers

Compressors/Engines	☐
Dehydrators	☐
Pipelines	☐
Pneumatics/Controls	☐
Tanks	☐
Valves	☐
Wells	☐
Other	■

Technology/Practice Overview

Description

Cryogenic nitrogen rejection units (NRUs) in gas processing plants are used to remove inert components from the sales gas to meet transmission pipeline standards. The separated nitrogen along with a small percentage of methane is often vented to the atmosphere through a reject stream.

The addition of monitoring and tracking equipment, such as a gas chromatograph to measure the methane content of the reject stream, will indicate when the NRU is in need of optimization. A unit specific process model of the NRU can help to optimize process variables, increasing methane recovery and minimizing operating costs. Routine optimization coupled with cleaning and maintenance of NRU heat exchangers increases process efficiency. These practices are reported to reduce the methane content in the nitrogen reject stream saving saleable gas and money.

Methane Savings: 200,000 Mcf/yr average per application

Costs

Capital Costs (including installation)

☐ <$1,000 ☐ $1,000 – $10,000 ■ >$10,000

Operating and Maintenance Costs (annual)

☐ <$100 ☐ $100-$1,000 ■ >$1,000

Payback (Years)

■ 0–1 ☐ 1–3 ☐ 3–10 ☐ >10

Benefits

The primary benefit of optimizing the NRU at a processing plant is the revenue from adding extra gas to the sales line. Secondary benefits include increased control over sales gas composition and reduced methane emissions from the nitrogen reject stream.

Operating Requirements

Optimizing a nitrogen rejection unit requires monitoring equipment, process analysis software, and a unit specific process model to develop changes to process variables that will reduce the amount of methane vented.

Applicability

Optimization techniques can be applied to all NRUs.

Methane Emission Reductions

The methane emission savings are based on reducing the methane composition of the nitrogen reject stream by 40% - 60% in a 50 MMcf/day NRU.

Economic Analysis

Basis for Costs and Savings

The methane savings were reported for a 50 MMcf/d (million cubic feet per day) NRU where the gas received was composed of approximately 60% nitrogen. Process adjustments, exchanger cleaning, and other maintenance based on the recommendations developed from the advanced NRU model reduced the methane content in the reject stream from 5% to 2%. This represents a reduction of methane loss in the nitrogen vent from 7.5% of feed methane to 3.75%. Development of an advanced process model and incremental maintenance costs for implementation of this opportunity are reported in excess of $70,000.

Discussion

Transmission pipelines have requirements for the heat content and inert composition of the gas that is delivered. The optimization of NRUs however, goes beyond requirements in order to save additional methane. Most NRUs are capable of running with a 1% methane content in the reject stream when optimized. The economics of optimizing a NRU are more attractive for larger units because the costs associated with a developing a process model and additional maintenance will be similar regardless of NRU capacity.